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BULLETIN

OF

THE JOHNS HOPKINS HOSPITAL.

Vol. V.—Nos. 44-45.] BALTIMORE, DECEMBER, 1894. [Price, 15 Cents.

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A CONTRIBUTION TO OUR KNOWLEDGE OF ORGANIC SULPHUR COMPOUNDS IN THE FIELD OF ANIMAL CHEMISTRY.[1]

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It is well known to workers in the field of animal chemistry that when freshly voided dog's urine is shaken up with milk of lime, or is made thoroughly alkaline with sodium or potassium hydrate, a peculiar, penetrating, offensive odor is developed; but beyond the merest passing references, nothing can be found in literature regarding the compound yielding this odor, and nothing seems to have been done toward determining its nature. Thus,[2] Böhm and Lange, discussing the applicability of Schlösing's method to the determination of ammonia in the dog's urine, remark that the addition to the urine of milk of lime gives rise to a peculiar, penetrating, garlicky odor, filling the whole bell-jar even after the lapse of 48–72 hours. V. Knieriem[3] makes a similar reference, but no one has gone farther than to note the presence of this odor.

There are many substances known to chemistry which may be said to have a penetrating, offensive, stupefying, and in some cases, garlicky odor. Among these are the mercaptans, the organic sulphides, selenides and tellurides, the phosphines and the isocyanides, but in the present instance no help was derived from the smell in identifying the body, as no one whose judgment was asked in the matter could state positively that the odor was like any other known to him.

I was obliged to direct my first efforts toward gaining some notion of the ultimate qualitative composition of the body. To this end I proceeded as follows: Air from an ordinary large glass gasometer was made to bubble through two liters of urine to which about 100 cc. of thick cream of lime had been added, and the whole thoroughly agitated for a few moments, and this air, laden with the odorous substance, was forced through an empty wash bottle, then through two Muencke's wash bottles made entirely of glass, each containing a 10 per cent. solution of hydrochloric acid, then through two similar wash bottles filled with a 40 per cent. solution of sodium hydrate, then through an empty bottle, and then through a piece of combustion tubing 60 centimeters long, filled in its middle third with asbestos fiber which had previ-

[1] The substance of a paper with the title: "On the occurrence of ethyl sulphide in the urine of the dog; on the behavior of ethyl sulphide dissolved in concentrated sulphuric acid toward oxidizing agents, and on certain reactions for the detection of alkyl sulphides," appearing in the December number of the Zeitschr. f. physiol. Chemie.

[2] Archiv f. exp. Pathol. u. Pharmakol., Bd. 2, p. 368.

[3] Zeitschr. f. Biol., Bd. X, p. 269.

ously been heated piece by piece to a white heat in the flame of a Barthel's alcohol blast-lamp. Pure oxygen taken from an Elkan's cylinder and well washed by being made to pass through both acid and alkali, was forced into the tube containing the purified asbestos at the point where the air laden with the odoriferous body entered it.

From the tube filled with the asbestos the current of air was next passed into a Geissler potash bulb half filled with a 2 per cent. solution of the purest hydrate of sodium. With the apparatus arranged as described, the combustion tube containing the asbestos was kept at a red heat in a short four-burner furnace for five hours, the air and oxygen passing at about the rate that is usual in combustion analyses.

At the end of this time a portion of the sodium hydrate solution in the Geissler bulb was acidulated with hydrochloric acid and tested with a few drops of a solution of barium chloride, with the result that an immediate precipitation of barium sulphate occurred. It may here be noted that the air current after it had passed the heated tube turned a blue litmus strip red, whereas it had no action on litmus before being heated, thus demonstrating that the sulphur of our compound had been turned from a neutral into an acid combination. A blank experiment in which the urine was replaced by distilled water was carried on for six hours, but in this case the sodium hydrate yielded no trace of sulphate. Our conclusion must therefore be that the volatile, odoriferous compound contains sulphur.

At this point two questions present themselves: First, can this sulphur compound be referred for its origin to the action of the hydrate of calcium upon one of the known so-called[1] "neutral" sulphur compounds of the urine, such as cystin and allied compounds, or such as hyposulphurous, sulphocyanic or mercapturic acids?

Second, does the air after passing through the system of wash bottles used in the combustion experiment, contain any other substances than this odoriferous compound?

The first question can be answered with considerable certainty by the method of exclusion. Cystin does not seem to be decomposed by treatment with milk of lime at room temperature. Baumann and Brenziger[2] have shown, however, that when ethyl cystein is heated with a free alkali, ethyl mercaptan is split off. M. v. Nencki[3] was the first to demonstrate that the nauseating odor of the urine after asparagus has been eaten is due to methyl mercaptan, and also that methyl mercaptan is one of the products of the bacterial decomposition of proteids.[4] Karplus[5] has also found methyl mercaptan in the urine as the product of a special bacterium, and L. v. Nencki[6] finds that it is always present among the gases of the large intestine. Because, then, of the proved occurrence of mercaptans in animal fluids, one cannot neglect making the proper tests for them where an offensive, not strictly definable odor is met with. But in the case under consideration the making of such tests will be seen to be unnecessary, for the very process of setting free our odoriferous compound with alkalies would have bound the mercaptans and prevented them from leaving the bottle, and an impassible barrier would also have been found in the wash bottles filled with sodium hydrate.

As for the other neutral sulphur compounds of the urine, the acids above mentioned, it may be remarked that the calcium and alkali salts of at least one of them, sulphocyanic acid, is stable and therefore could not come in question. The alkali salts of hyposulphurous acid are readily soluble and stable; the calcium salt is equally soluble but unstable.

Now, to exclude hyposulphurous acid as a possible source of the sulphur found in our combustion experiment, we have only to state that this experiment yielded the same result when fixed alkali instead of milk of lime was used to free the odoriferous substance. But even with the employment of calcium hydrate it seems hardly possible for sulphur dioxide to escape from a fluid containing such an excess of lime.

As to the mercapturic acids being a possible source of our sulphur compound, we have only to note Baumann's[1] discovery that when they are decomposed with alkalies mercaptans are split off, a fact that has been adopted into the methods of urinary analysis. But we have demonstrated that it would be impossible for a mercaptan to pass over into the combustion tube. A further proof that excludes both the mercaptans and also sulphureted hydrogen is seen in the fact that two strips of filter paper moistened with alkaline lead solution and placed, the one between the bottle of urine and the first wash bottle, and the other between the last wash bottle and the combustion tube, never showed the slightest change of color.

It is therefore fair to conclude that our sulphur compound is not a derivative of one of the known "neutral" sulphur compounds of the urine, but that it is split off by the milk of lime from a still unknown sulphur compound of the urine.

We now turn to the second question: Does the air after passing through the system of wash bottles used in the combustion experiment contain any other substance besides this odoriferous compound? If we bear in mind the contents of the series of wash bottles, it will be seen that no substance with acid or basic properties could have passed them; in other words, that only a chemically indifferent substance could have been found with the sulphur compound at the end of the series of bottles. This disposes not only of the mercaptans, but of all the various compounds spoken of in the beginning as having an odor similar to the compound in question, with the sole exception of the organic sulphides.[2]

The phosphines, too, are excluded, for, being basic substances,[3] they would be held back by the hydrochloric acid. Then, too, the phosphines are very readily oxidized, and in

[1] Salkowski: Archiv f. path. Anat. u. Physiol., Bd. 58, p. 472.

[2] Zeitschr. f. physiolog. Chem., Bd. 16, p. 565.

[3] Archiv f. exp. Pathol. u. Pharmakol., Bd. 28, pp. 206–209.

[4] M. v. Nencki and N. Sieber: Monatsh. f. Chemie, Bd. 10, pp. 526–31.

[5] Archiv f. pathol. Anat. u. Physiol., Bd. 131, pp. 210–222.

[6] Sitzb. d. kais. Akad. in Wien, Mathem. Classe III, Abth. 98, pp. 437–8.

[1] Baumann: Zeitschr. f. physiolog. Ch., Bd. 8, p. 194.

[2] The selenides and tellurides are obviously out of the question as constant products of animal metabolism, but see a late interesting paper by F. Hofmeister in Arch. f. exp. Pathol. u. Pharmakol., Bd. 33, p. 198, on the ability of the organism to form the nauseating methyl telluride and selenide on the introduction of selenium and tellurium or the salts of their acids.

[3] With the exception of the primary phosphines.

small amounts could not be made to bubble up through so many wash bottles without being destroyed by this long contact with the air. A long series of experiments was, in fact, undertaken to determine whether or not a volatile phosphorus compound was present along with the sulphur compound *before* it was washed, but all with negative results.

It therefore seemed fair to assume that our sulphur compound was the only substance carried by the air through the series of wash bottles, and all the subsequent experiments made to establish its identity furnish additional support for this assumption.

SOLUTION OF THE COMPOUND IN CONCENTRATED SULPHURIC ACID, AND PROPERTIES OF THIS SOLUTION.

A series of experiments was next undertaken to determine how this sulphur compound could be collected in sufficient quantities for study and analysis. It was finally found that concentrated sulphuric acid completely absorbed the body and the resulting solution is without color and also without odor, unless the air current is allowed to bubble through the sulphuric acid for several days, when a faint oniony smell is perceptible. In concentrated sulphuric acid we have then a means of storing considerable quantities of this sulphur compound.

Chapman suction pumps were used to draw air through large flasks containing urine and milk of lime, then through two wash bottles containing a 10 per cent. solution of hydrochloric acid, then through two wash bottles filled with a 40 per cent. solution of sodium hydrate, then through a U tube 12 inches high and 1 inch in diameter filled with pieces of potassium hydrate, then through two similar U tubes filled with granular calcium chloride, and from this last tube the air laden with the sulphur compound passed through a Geissler bulb or through a small wash bottle containing concentrated sulphuric acid. The connections between the bottles were glass to glass held in place by the best black English tubing. Two such circuits were usually kept at work by the same suction pump, and the pump was operated day and night. After about 72 hours, in which time 15–20 liters of dog's urine had been exhausted of the sulphur compound, the Geissler bulb containing sulphuric acid was replaced by another. On diluting with water some of this concentrated sulphuric acid that has been charged with the body, or on neutralizing it with free alkalies, or on the addition of almost any metallic salt at hand, an intense odor like that of one of the organic sulphides pervades the room. These properties of dissolving in considerable quantities in sulphuric acid and of forming with it a nearly or quite odorless solution, and of being set free unchanged on dilution with water or on neutralization of the sulphuric acid, are possessed, so far as I know, by the sulphides[1] only among organic sulphur compounds. I have repeatedly dissolved 10 or 12 grams of ethyl sulphide in 100 cc. of concentrated sulphuric acid, having previously cooled both fluids, and found that the resulting solution had no odor whatever, but on adding to this solution half its weight of water, or, better still, of ice, the ethyl sulphide soon appeared floating on the top of the diluted sulphuric acid. Dimethyl sulphide and methyl ethyl sulphide were found to behave in the same way. Reference books on chemistry do not mention this property, and it was only after the completion of my experiments that I learned that this method is employed in refining crude Ohio petroleum, and that Mabery and Smith[1] had by its help recovered alkyl sulphides from the "distillates of crude petroleum."

[1] In all probability, however, the analogous selenides and tellurides behave in the same way toward concentrated sulphuric acid.

OXIDATION OF THE URINARY SULPHIDE.

The alkyl sulphides are readily oxidized to the fluid sulphoxides, and then further to the very stable crystalline sulphones. Thus, if ethyl sulphide, $(C_2H_5)_2S$, is oxidized with nitric acid, specific gravity 1.2, ethyl sulphoxide, $(C_2H_5)_2SO$, is produced, a thick, unstable fluid, easily soluble in water. If, however, fuming nitric acid is used, then diethyl sulphone, $(C_2H_5)_2SO_2$, results, which crystallizes in large rhombic plates very soluble in water, melting at 70° and distilling at 248° without decomposition. The sulphoxides have the property of being reducible with zinc and sulphuric acid to the original sulphide. The sulphones, however, are very stable substances, unaffected by treatment with zinc and sulphuric acid. It was hoped that oxidation of the concentrated sulphuric acid solution of the sulphide from the dog's urine with potassium permanganate would yield a sulphone, the composition and properties of which would determine which particular sulphide we were dealing with. Accordingly, about 100 cc. of a concentrated sulphuric acid solution containing the sulphur compound collected from about 25 liters of dog's urine was treated in the following manner: A beaker containing it was placed in pounded ice, and from time to time were added a few drops of a concentrated aqueous solution of potassium permanganate, also cooled to 0° C. When the permanganate ceased to be decolorized, a cold 4 per cent. solution of sulphuric acid was slowly added until the acid in the beaker was reduced in strength to about a 20 per cent. solution. The whole was then heated on the water-bath, while potassium permanganate was again added.

Under the influence of the heat an additional quantity of the permanganate was reduced, and the heating on the water-bath was kept up as long as any permanganate was decolorized.

The slight excess of permanganate, when reduction no longer occurred, was removed by the addition of a little sodium formate.

The solution was then made alkaline with potassium hydrate, evaporated till crusts of potassium sulphate formed; the potassium sulphate filtered off, again concentrated, again filtered, and now evaporated to dryness. The dry residue was extracted with a little absolute alcohol, half of the alcohol evaporated on the water-bath and the rest allowed to evaporate

[1] Americ. Chem. Journ., Vol. 13, p. 243, and Vol. 16, p. 38. R. H. Smith has also treated ethyl sulphide with an equal bulk of strong sulphuric acid diluted with much water and neutralized with barium carbonate for the purpose of forming barium-ethyl-hyposulphite, but makes no mention of the separation of the sulphide on dilution with water. Journ. of the Chem. Soc., 22 (1869), p. 302.

spontaneously. A small quantity of a deliquescent compound remained. To remove all trace of potassium carbonate, the residue was extracted a third time with absolute alcohol, and the alcohol again evaporated. On the addition of dilute sulphuric acid to some of the deliquescent residue, the odor of acetic acid became very apparent. The characteristic odor of acetic ether was at once brought out on gently heating with the addition of concentrated sulphuric acid and alcohol, and the addition of ferric chloride to a neutral solution gave the characteristic blood red color of a solution of ferric acetate. These properties, viz., the deliquescence of the potassium salt, the odor of the free acetic acid and of its acetic ether, and the color of its ferric salt, leave no doubt of the occurrence of acetic acid as an oxidation product of the sulphur compound under examination. I was unprepared for this outcome, as I had hoped to secure a sulphone. On the supposition that a little of the sulphone might yet be mixed with the acetate, I acidulated its aqueous solution with sulphuric acid, drove away the acetic acid as far as possible on the water-bath, and again extracted the dry residue with alcohol, but only a trace of potassium acetate and sulphate was taken up. I now repeated the oxidation experiment twice over, making slight variations in the method, such as the employment of finely powdered potassium permanganate instead of an aqueous solution, and sodium instead of potassium hydrate, in the neutralization. I used also a little less than the necessary amount of permanganate, so as to avoid the after-use of sodium formate, but the final outcome was the same as before: an acetate again appeared.

A blank oxidation experiment was next undertaken in order to determine whether the reagents used contained any thing oxidizable to acetic acid, but not a trace of acetate was found.

We may therefore safely conclude that our sulphur compound contains one or two ethyl groups. It is not easy to draw conclusions as to the presence of a methyl group in the sulphide, as such a group would have been oxidized to carbon dioxide and water. Carbon dioxide is, in fact, given off when the acid solution and permanganate are boiled, but this can be referred to the destructive oxidation of some of the sulphide, for it also takes place when synthetically prepared diethyl sulphide is treated in the same way.

OXIDATION OF SYNTHETICALLY PREPARED ETHYL SULPHIDE UNDER THE SAME CONDITIONS.

It was now in order to compare the behavior of synthetically prepared ethyl sulphide with our sulphide. Accordingly, a preliminary experiment was first made as follows: Five grams of ethyl sulphide, which distilled at 91.9°–92° C., were dissolved in 50 cc. of sulphuric acid, and oxidized by adding small quantities of powdered permanganate very gradually to the concentrated sulphuric acid kept in a freezing mixture, an hour and a half being consumed in adding 12 grams. When too much was added at one time, a flash of light would appear, showing that some of the sulphide was being completely oxidized, and the odor of ethyl sulphide also became apparent. 25 cc. of cold concentrated sulphuric acid were now stirred into the mixture, and from time to time small portions of a concentrated aqueous solution of permanganate were added together with about 20 cc. of water. A colorless solution of an oniony odor now resulted and this was slowly diluted with water up to a liter, permanganate still being added. The solution was then boiled for a short time and as the permanganate was still being reduced, more was added. When no more permanganate was reduced about 200 cc. of the fluid was distilled off. This distillate, which was plainly acid, was caught in a little strong potassium hydrate and subsequently enough more hydrate was added to give a neutral reaction, and it was then evaporated on the water-bath. There was obtained a small quantity of a deliquescent salt consisting of potassium carbonate and potassium acetate, which gave the reactions that we have already mentioned as sufficient to identify acetic acid. In a similar experiment it was observed that when the distillation was undertaken before the oxidation was complete, that is, at a time when the permanganate was still being reduced, the distillate had a most disagreeable odor, reminding one both of onions and of acetic acid. Also when evaporated to dryness with an alkali, it gives all the reactions of a sulphite, viz., it reduces permanganate, it yields sulphureted hydrogen on reduction with zinc and sulphuric acid, it decolorizes an iodine starch solution, it gives a red color to a weak solution of sodium nitroprusside, and it gives off the peculiar stinging odor of sulphur dioxide on acidulation with sulphuric acid. In such a case, therefore, one must first oxidize the sulphurous acid with permanganate before undertaking the tests for acetic acid or the preparation of one of its salts. When boiling is resorted to in order to hasten the progress of the oxidation, it is found that much carbon dioxide is given off. It is evident that in the above experiments the greater part of the sulphide was oxidized to the end products, sulphuric anhydride, carbon dioxide and water.

As, to my knowledge, the alkyl sulphides have hitherto only been oxidized to sulphoxides and sulphones, and not as in the manner indicated above, to acetic and sulphuric acids, it seemed worth while to attempt the quantitative oxidation of ethyl sulphide to these latter products. Accordingly, 12 grams were dissolved in 100 cc. of concentrated sulphuric acid, the latter being cooled in a freezing mixture; 65 grams of finely powdered permanganate, somewhat less than the quantity theoretically necessary to oxidize the sulphide to acetic and sulphuric acid, were then dissolved in 200 cc. of cold sulphuric acid, and this solution was slowly added to the cold solution of the sulphide. The permanganate was at first entirely decolorized and none of the sulphide was liberated or destroyed, but toward the end of the operation, as more and more of the oily heptoxide of manganese from the bottom of the beaker came to be added, the black mixture began to foam up, flames now and then shot forth and much carbon dioxide was given off. A repetition of the experiment led to no better results. In both cases, however, water was added to the black, agitated mass, and after diluting to about a liter, the odor of acetic acid became plainly perceptible. When diluted to several liters and distilled, a little of the distillate treated as before gave all the tests for acetic acid. A little silver acetate was also produced which crystallized out of water in

long, shining needles, gave off fumes of acetic acid, deposited silver on gentle incineration, and also emitted the odor of ethyl acetate on treatment with concentrated sulphuric acid and alcohol.

On account of the fact, however, that by far the greater part of the sulphide had been destroyed, it was evident that it would be useless to attempt the estimation of the amount of acetic acid produced. It would seem, therefore, impracticable to oxidize ethyl sulphide in this way with the intention of securing a large output of acetic acid, but any one can convince himself by an off-hand experiment that acetic acid is one of the products of the oxidation of diethyl sulphide under the above circumstances. This is another point of agreement between the sulphide from dog's urine and ethyl sulphide.

What light this oxidation throws on the nature of the union existing between ethyl sulphide and concentrated sulphuric acid, and also whether thio-acetic acid may not be an intermediate product in the oxidation with permanganate, I cannot here discuss.

DOUBLE COMPOUND WITH MERCURIC CHLORIDE.

As the new sulphur compound from the dog's urine has so many points in common with ethyl sulphide, its behavior towards mercuric chloride was next examined.

Some of the concentrated sulphuric acid solution of the sulphide from the dog's urine was placed in an ice mixture and diluted with a cold 4 per cent. solution of sulphuric acid until the resultant liquid was equal in strength to about a 30 per cent. sulphuric acid solution. The odor found to arise from such large amounts of the diluted fluid was very strong, and not to be distinguished from the odor of ethyl sulphide dissolved in concentrated sulphuric acid and treated in the same way. Indeed, none of the workers in my laboratory could tell in any given case whether I was using the compound obtained from dog's urine or that synthetically prepared. The diluted solution of the sulphide was now shaken out with ether and the separated ether was washed twice with distilled water; an alcoholic solution containing 1 gram of mercuric chloride was then added to the ether and the whole evaporated to about one-third on the water-bath, after which it was allowed to stand *in vacuo* over sulphuric acid. The residue, which smelled strongly of the sulphide, was well washed on a filter with water in order to dissolve away the excess of mercuric chloride. It was then dried on the filter over sulphuric acid, dissolved when dry in a little alcohol and allowed to crystallize. Some of the crystals, long, slender prisms mixed with some amorphous material were collected and their melting-point taken without further purification. This was found to be in one case about 145° C., and in another batch of crystals prepared in a very similar manner, 150° C. The noteworthy fact in both determinations was that the crystals melted to a black fluid, and after the capillary tubes had cooled, long slender prisms could be seen to stand out from the congealed drop.

I am personally convinced that this sulphide from the urine of the dog forms a double compound with mercuric chloride, although it must be admitted that the evidence, so far as its melting-point is concerned, does not furnish conclusive proof that this compound is $(C_2H_5)_2S.HgCl_2$.

In support of this opinion that a double compound is formed, we may urge the odor of the compound, its insolubility in water, its solubility in alcohol, its behavior in the melting tube and its crystalline character. After standing over sulphuric acid *in vacuo*, no odor, or at least only a very faint odor, is perceptible; but exposed to the air for only a few moments, the odor of the sulphide becomes very marked. The mercuric chloride compound of ethyl sulphide behaves in the same manner.

It is exceedingly difficult to separate a small amount of this unstable double compound, say a few centigrams, from an excess of mercuric chloride; the various operations, such as the long and repeated washings with water, the necessary drying, etc., all involve so much loss of substance that sharp results cannot be obtained when there is only little material on hand.

MELTING-POINT OF THE DOUBLE COMPOUND, $(C_2H_5)_2S.HgCl_2$.

The plan that was followed above in the attempt to secure and purify the double compound of ethyl sulphide from the dog's urine was based on previous experiments made in the same way with synthetically prepared ethyl sulphide. Five grams (boiling-point 91.9° C.) were dissolved in 50 cc. of concentrated sulphuric acid, and by following out the method described above, except that less of the theoretically required amount of mercuric chloride was used, the double compound crystallizing out of absolute alcohol in long, transparent, highly refracting prisms was obtained. This, recrystallized out of alcohol, washed with cold absolute alcohol and ether, and dried *in vacuo* over sulphuric acid and paraffine, began to melt at 118° C. and melted to a colorless fluid at 119° C. Subsequent recrystallizations out of ether caused no change in the melting-point. When the double compound is prepared by mixing alcoholic solutions of the sulphides and of mercuric chloride the melting-point is also 119°.

When some of the finely powdered crystals that show a melting-point of 119° are allowed to stand over sulphuric acid for two weeks, the melting-point is found to have risen to 131° C. Some of the unbroken crystals, however, that had stood for the same length of time over sulphuric acid melted at 120° C. When the temperature reached 180°–185° C. a rapid evolution of gas bubbles took place, but the liquid remained transparent and did not blacken.

Now Loir[1] gives 90° C. as the melting-point of $(C_2H_5)_2S.HgCl_2$ crystallized out of ether. An observation made by me in the course of the above experiments may perhaps explain how Loir came to put the melting-point at 90° C. I prepared some of the ethyl sulphide mercuric chloride, recrystallized it out of absolute alcohol, washed it with absolute alcohol and ether, and exposed it for half an hour to an air current produced by a Bunsen suction pump. At the expiration of this time the melting-point was taken and it was found that the substance melted at 80° C., yielding a perfectly transparent, colorless

[1] Ann. d. Chem. u. Pharm. 87, p. 370.

liquid. After standing for twelve hours over sulphuric acid *in vacuo* the melting-point was found to have risen to 119° C.

It may be remarked in passing that Blomstrand[1] finds one of Loir's melting-points, that of the platinum compound $2(C_2H_5)_2S.PtCl_4$, 70° too low, it being in reality 178° instead of 108° as given by Loir.

BEHAVIOR OF THE SULPHIDE TOWARD SOLUTIONS OF BROMINE AND IODINE.

It must be remembered that we are confined to solutions of the urinary sulphide in concentrated sulphuric acid for a study of its properties. The behavior of bromine and iodine toward these solutions is characteristic and in every respect like their behavior toward similar solutions of synthetically prepared ethyl sulphide. If a drop or two of a 2 per cent. solution of bromine in potassium bromide be added to a sulphuric acid solution of the urinary sulphide, or to an equally weak solution of ethyl sulphide, it will be observed that bromine is absorbed. The same thing is observed when bromine vapor is allowed to fall into a sulphuric acid solution that has previously been diluted with a few drops of water. If the sulphuric acid be poured off from the undissolved drop of bromine after having been thoroughly agitated with it, and then be diluted with water, it will be found that the sulphide odor no longer returns. If a piece of pure washed zinc and a little more concentrated sulphuric acid be added, the sulphide odor returns as the reduction proceeds. A solution of ethyl sulphide of about the same strength as that from the dog's urine behaves in the same way. But if a strong solution be made, the absorption of bromine is very evident, for now considerable bromine may be added before some of it remains undissolved. Such a concentrated solution of ethyl sulphide treated with bromine still smells somewhat of the sulphide after dilution with water, but if left to stand for a few days the odor disappears, and may then be caused to reappear on reduction with zinc and sulphuric acid. We are in all probability dealing here with the bromine addition compound $(C_2H_5)_2SBr_2$, which, as described by Rathke,[2] forms with water a colorless solution. Out of its aqueous solutions, iodine in potassium iodide precipitates an iodine addition product, $(C_2H_5)_2SI_2$, as a dark oily fluid.

Far more striking is the behavior of iodine, the study of which has led to a reaction which may under certain circumstances serve to indicate the presence of an alkyl sulphide. On the addition of a few drops of a 6–10 per cent. solution of iodine in potassium iodide, or of a $\frac{1}{10}$ normal iodine solution, an immediate precipitation occurs. The sulphuric acid solution becomes a dark brown, turbid fluid in which a precipitate of infinite fineness is suspended. After standing over night a small quantity of a dark brown oil separates out in minute droplets and settles to the bottom. This is undoubtedly the addition product $(C_2H_5)_2SI_4$.[3]

If the acid be poured off and water be added to this oily substance, the odor of a sulphide becomes at once apparent. The addition of a few drops of potassium hydrate immediately causes the oil droplets to dissolve, and brings out the sulphide odor in full strength. Iodine solutions also cause the dark cloudy precipitations in sulphuric acid solutions of the sulphides even when these are very much diluted with water, so that this reaction must be regarded as a very sensitive one.

Furthermore, a drop or two of the sulphide shaken up with much distilled water, say 60 cc., also gives a cloudy precipitate on the addition of a $\frac{1}{10}$-normal iodine solution, and this precipitation occurs even when the aqueous solution has been allowed to stand for weeks, when we may be sure that the ethyl sulphide is really dissolved and not merely suspended. Out of these aqueous solutions of the sulphide to which iodine solutions have been added, the oily product referred to also settles on standing. This last reaction demonstrates very clearly that ethyl sulphide, contrary to the usual statements, is by no means insoluble in water. I daresay that its solubility in water is fully equal to that of ethyl mercaptan.

Methyl sulphide and methyl ethyl sulphide behave in almost the same way toward solutions of iodine. The oily compound that is precipitated from dilute solutions of methyl sulphide in sulphuric acid seems, however, to pass again into solution on standing.

If to a distillate of dog's urine that has been shaken with milk of lime or made strongly alkaline with a free alkali, a few drops of an $\frac{N}{10}$-iodine solution be added, a cloudy precipitation, very like that seen under the same circumstances in aqueous solutions of ethyl sulphide, will be observed. In this instance, however, the reaction is of uncertain meaning, for Schiff[1] has shown that the distillate of the dog's urine contains a primary amine, and Abbott[2] has found that aqueous solutions of amines give cloudy precipitates on addition of $\frac{N}{10}$-iodine solution.

BEHAVIOR OF ETHYL SULPHIDE TOWARDS NITROUS ACID.

While trying to establish the identity of the sulphide treated of in this paper, I observed that when a drop of an aqueous 5 per cent. solution of sodium nitrite was added to some of the sulphuric acid solution of the sulphide from the dog's urine, the latter at once took on a beautiful deep green color. A drop or two of Liebermann's[3] nitrose sulphuric acid solution gives the same color and is preferable as a reagent to an aqueous solution of a nitrite, as if used in excess it does not so readily cause the disappearance of the green color. The color persists for some time, but disappears if the solution is left to stand over night, and when the nitrite is not added in excess the reaction will be found to be of great delicacy.

To get this reaction with the urinary sulphide in perfection it is best to conduct the well-dried air and sulphide as

[1] Jour. f. pract. Chem. (n. f.), Vol. 24, p. 190.
[2] Ann. d. Chem. u. Pharmac., Bd. 152, p. 214.
[3] Rathke, *loc. cit.*

[1] Zeitschr. f. physiol. Chemie, Bd. IV, p. 54.
[2] Private communication from Dr. A. C. Abbott, of the hygienic laboratory of the University of Pennsylvania, on the detection of amines in sewer air with N/20-iodine solution, which induced me to study the behavior of aqueous solutions of ethyl sulphide toward iodine solutions.
[3] Ber. d. deutsch. chem. Gesellsch., Bd. 20, p. 3231 b. In making up the solution of a nitrite in conc. sulph. acid I used sodium instead of potassium nitrite.

described on p. 125, with at least 5 or 6 liters of urine in the circuit, through a few cc. of concentrated sulphuric acid in a test tube an entire day. Special attention must be given to the drying of the air laden with the sulphide, for it is only when a completely dry current is passed into the concentrated sulphuric acid for the length of time named that a solution is obtained which will give at once the deep green color referred to, although solutions that have not remained so long in the circuit will also give a tinge of green, in which case, however, only a mere trace of the nitrite, such as adheres to a glass rod dipped into a solution of it, should be added. Now a drop or two of pure ethyl sulphide dissolved in a few cc. of concentrated sulphuric acid gives identically the same reaction on the addition of a drop or two of a nitrite solution or of nitrose sulphuric acid.

WHAT CHEMICAL CHANGES OCCUR IN THIS REACTION?

As long as the color persists, the sulphide can be liberated by the addition of small pieces of ice or by dilution with water, but after standing over night exposed to the action of an excess of the nitrose sulphuric acid, the now colorless solution no longer throws out the sulphide on the addition of ice. The reason for this is that the sulphide has been slowly oxidized by the nitrous acid to a sulphoxide, while the latter is reduced to nitric or nitrous oxide. That this oxidation has occurred is demonstrated by adding a few pieces of zinc and allowing the reduction to continue for some hours and then diluting with crushed ice, when the original sulphide will again make its appearance. No further demonstration is needed to prove that the sulphide has been oxidized to a sulphoxide in the above experiment. Since methyl sulphide and methyl ethyl sulphide also behave in the same way toward nitrose sulphuric acid, it is fair to conclude that the reaction holds for the series of sulphides of the general formula $(C_nH_{2n+1})_2S$.

It might be suspected that the color reaction just described is due to thiophene formed on dissolving the sulphide in concentrated sulphuric acid, in analogy with the pyrogenous synthesis of thiophene first demonstrated by Kekulé.[1] That we are not dealing with thiophene is, however, shown by the absence of that characteristic play of colors (green, blue to purple) that is always observed when a little nitrose sulphuric acid is added to a freshly prepared sulphuric acid solution of thiophene, and by the fact that a solution of thiophene in concentrated sulphuric acid soon fails to give Liebermann's reaction, in consequence of the rapid conversion of the thiophene into thiophene sulphonic acid. Then, too, that the green color described does not owe its origin to thiophene is proved by the fact that solutions of ethyl sulphide in concentrated sulphuric acid do not give the indophenine reaction, a reaction quite as delicate as Liebermann's reaction for thiophene.

The mercaptans, too, do not appear to give this reaction. As is well known, these sulphur compounds, when dissolved in concentrated sulphuric acid, are changed to the corresponding disulphides. Sulphuric acid solutions of ethyl mercaptan, the only one of the mercaptans that I have thus far prepared for comparison, become murky and take on a reddish yellow color on the addition of a few drops of Liebermann's solution. The sulphides of the series $C_nH_{2n}S$ also fail to give this reaction.[1] Ethylene sulphide and propylene sulphide, when dissolved in concentrated sulphuric acid in small amounts, yield slightly green solutions. On the addition of a few drops of nitrose sulphuric acid the green color instantly disappears, giving place in the propylene solution to a yellowish turbidity, while the ethylene solution remains colorless. Methylene sulphide gives a colorless solution with concentrated sulphuric acid, which undergoes no change on the addition of the nitrose sulphuric acid.

It may be mentioned in conclusion that the vapor of pure ethyl sulphide was subjected to a destructive oxidation by passing it mixed with moist oxygen over asbestos heated to redness, exactly as described in the combustion experiment with the urinary sulphide in the early part of this paper. Here, too, the air that escaped from the combustion tube was laden with acid vapors, and an examination of the weak sodium hydrate solution in the Geissler bulb showed that sulphuric acid was present. When the supply of oxygen was insufficient, the bulb also contained sulphurous acid.

HAS THE SULPHIDE AN INTESTINAL ORIGIN?

The fact that methyl mercaptan is found among the gases of the large intestine,[2] and that there exists between ethyl mercaptan and ethyl sulphide a close relationship, suggests for the latter a possible intestinal origin, and that after absorption it unites with a compound that prevents its oxidation to end products and allows of its excretion in the urine. But an experiment in intestinal antisepsis[3] with calomel performed on a large well-nourished dog, showed after six days of abstention from all food except water and the administration of a total of 8 grams of calomel during the last three days, no appreciable diminution of the amount of the sulphide yielded to concentrated sulphuric acid. While this result is not absolutely conclusive because of the lack of quantitative methods for estimating the sulphide, and also because we cannot be certain that the bacterial activity in the intestines was completely suppressed, yet the evidence, so far as it goes, is against the bacterial origin of the sulphide. More conclusive is the negative outcome of all attempts to find the sulphide in the fæces of the dog by the use of the methods successfully applied to the urine.

The negative outcome of both experiments at least points to the probability that ethyl sulphide is a product of retrogressive metabolism. The urine, too, appears to contain decidedly more of the compound when the dogs are put on an exclusively meat diet than when fed on the mixed diet of refuse from the hospital kitchens.

So far as I have been able to discover, crude petroleum is the only other natural source besides the dog's urine, of the

[1] See V. Meyer: Ber. d. deutsch. chem. Gesell., Bd. 18, p. 217 a.

[1] This point was not established in time for its appearance in the German version of this paper.

[2] L. v. Nencki: Sitzb. d. kais. Akad. in Wien, Mathem. Classe III, Abth. 98, 437-438.

[3] Baumann: Zeitschr. f. physiol. Chem., Bd. 10, 1886, S. 129.

saturated alkyl sulphides. Now that we have methods for their detection, it is not unlikely that they will be found to be as widely distributed as are the mercaptans. I hope soon to be able to offer something definite as to the properties of the compound from which the sulphide is liberated in the dog's urine on treatment with alkalis, and also to be able to isolate the pure sulphide in sufficient amount for the determination of its boiling-point, etc. It is only after having accomplished the isolation of the compound with which the sulphide is united that we can say anything definite as to amounts in which the sulphide is excreted. Since, however, easily demonstrable quantities of sulphuric anhydride can be obtained by oxidizing its vapor, one is justified in the opinion that it is present in equal or greater quantity than are such compounds as sulphocyanic or thiosulphuric acid. And it seems fair to conclude that it will be found on quantitative estimation to answer to the still unidentified sulphur compounds in the dog's urine.

RESUMÉ.

It will be seen that the difficulties encountered in the collection and study of the new compound were not few. The following points have, however, been clearly established:

1. When dog's urine is treated with alkalies, an odoriferous compound is liberated which contains sulphur and which is taken up with avidity by concentrated sulphuric acid and from which it is again liberated on dilution with water or on neutralization. The odor arising during the progress of the dilution or neutralization is not to be distinguished from that of ethyl sulphide, $(C_2H_5)_2S$. Ethyl sulphide is likewise absorbed by concentrated sulphuric acid with great avidity.

2. Oxidation of the urinary compound in the form of its solution in concentrated sulphuric acid yields sulphuric and acetic acids, thus demonstrating the presence in it of an ethyl group. Oxidation of ethyl sulphide under the same conditions yields the same products.

3. Mercuric chloride forms with the urinary sulphide a double compound which behaves, as far as could be determined, in regard to odor, solubility and crystallization, like the corresponding ethyl sulphide mercuric chloride, $(C_2H_5)_2S.HgCl_2$.

4. Bromine and iodine behave toward its solutions in concentrated sulphuric acid in every way as toward similar solutions of ethyl sulphide.

5. A nitrite added to its solutions in concentrated sulphuric acid gives the same intense green color as with solutions of ethyl sulphide.

6. The organic sulphide thus shown to exist in dog's urine is ethyl sulphide, $(C_2H_5)_2S$. The mixed sulphide, methyl ethyl sulphide $(CH_3.C_2H_5)S$, might be thought to have an equal claim with ethyl sulphide as a urinary constituent, since its solutions in concentrated sulphuric acid behave in the same way toward bromine, iodine and nitrous acid, and since the products of its oxidation by the method described are the same, but pure methyl ethyl sulphide that has been several times rectified is easily distinguishable from ethyl sulphide by its odor, which has an additional smell like that of rotten cabbages, not possessed by the latter.[1]

PURELY CHEMICAL RESULTS.

The points of more especial chemical interest are:

1. The oxidation of ethyl sulphide to acetic and sulphuric acids.

2. Its great solubility in concentrated sulphuric acid, and the ease with which it can again be liberated from this solution even when dissolved in minute quantities.

3. Its oxidation to a sulphoxide by nitrous acid and its green color reaction with this reagent.

4. Its solubility in water and the ease with which its aqueous solutions can be detected with solutions of iodine in potassium iodide.

5. Also to be noted is the fact that the melting-point of ethyl sulphide mercuric chloride lies at 119° C., and not at 90° C. as stated by Loir and since his time in all reference books on chemistry.

[1] See J. Finckh (Ber. d. deutsch. chem. Gesellsch., 1894, No. 9, p. 1239), who finds that these organic sulphides lose their nauseating odor on being repeatedly heated to 290°–300° C. in a sealed tube with powdered copper.

A CASE OF PARANOIA, WITH A STUDY OF THE CEREBRAL CONVOLUTIONS.

By Henry J. Berkley, M. D., *Clinical Lecturer in Psychiatry.*

Since the pathology of the mental disease known as primary paranoia is entirely unknown, the macroscopic examination of the brain in this case may not be devoid of clinical interest. The reader's attention is particularly called in the right hemisphere to the region of the post-central furrow, the very broken arrangement of the gyri of the parietal region, the unusual development of the third frontal convolution, short, broad, and standing isolated from the other convolutions of the lobe except on its orbital aspect. The external aspect of the left hemisphere is much more in conformity to recognized types, but the inner surface has many points of dissimilarity with the opposite brain-half. Altogether the impression given by both hemispheres is considerably at variance with the usual types of convolutional development, and the asymmetry between the hemispheres is very marked.

The early history of the patient, Sarah Janet N——n, is to a large extent shrouded in obscurity. Born in Scotland of respectable parents, she was given a fairly good education, and though moderately intelligent, she preferred wandering in the fields with the sheep and heather, to attending school.

She stated that she was always on good terms with her school companions, but at home was restless, all her affections centering in a sister, to the exclusion of the rest of the household. The parents, as well as the brothers and sisters, are

represented as being healthy, mentally and physically. She also stated that she was married at an early age, and had two children by this husband and another by a lover.

About the age of thirty-five years she emigrated to this country and obtained employment as a housekeeper. She seems to have been fairly successful in giving satisfaction to her employers, though there were several changes during the five years previous to her admission to the City Asylum, and she was discharged from her last situation by reason of her quarrelsome disposition.

In 1890, when she was in her thirty-ninth year, the climacteric began, and by the commencement of July, 1891, all evidence of menstruation had ceased. There were during the menopause hemorrhages of some intensity from the uterus, for which she was treated at one of the city hospitals, where she resided several months and until she was obliged to leave. Finally she was sent to the City Almshouse (admitted August 6, 1889), where it was soon recognized that she was insane, being irritable, suspicious, and having marked delusions of persecution, the principal ones being that for a person of her position she was not treated with sufficient respect by the officers of the institution, and that her food was poisoned.

These delusions led to a number of outbreaks of violence against the inmates of the almshouse, and proceeded to the extent of an attack upon the superintendent, and on July 27, 1892, she was transferred to the City Insane Asylum.

At the time of her admission N. was extremely suspicious, and it took the physicians in attendance some time to gain her confidence, and then only by a complete acquiescence with her delusions, the slightest correction annihilating any one in her esteem, and afterwards it was impossible to make her hold any communication.

The patient was a tall, angular woman, without any marked signs of somatic degeneration. The skull was sub-brachycephalic, without irregularity in the cranial bones. Physical examination showed the viscera to be healthy with the exception of the lungs, these showing the signs of a beginning tuberculosis at the apices. The heart's action was steady, regular, and without abnormal murmur. There was no history of a traumatism, alcoholism, or of a previous attack of any of the infectious diseases, to supply an etiological factor for the development of the mental trouble.

After the few days necessary to overcome the suspicions she entertained in respect to the medical staff of the hospital, she unburdened herself fully of her troubles and insistent ideas. Delusions of persecution were strongly marked, but by no means paramount. On account of her *mission* she was molested and persecuted by a multitude of enemies, and though she made a strong effort to preserve outward calmness, occasionally she burst into a torrent of invective upon the heads of her enemies, magnifying the smallest offense against herself into mountains of malice and wickedness.

The delusions of persecution were, however, of small interest in comparison with other fixed ideas, and by contrast sank into the background. N. believed that she was a prophetess called of God, and was the "woman clothed with the sun, and the moon under her feet, and upon her head a crown of twelve stars," of the XII chap. of the book of the Revelation, and that her present abode represented the allegorical wilderness where she was to be fed for a space of one thousand three hundred and threescore days, the time representing that of her earthly tribulations, at the end of which period there was to be the judgment day, and without dying she was to be translated to the presence of God. Not only was she to be translated undying, but in some way now unknown to her, and only to be revealed on that great and awful day, she was to take a chief part in the redemption of the human race and intercede between them and the Almighty. At the end of the day of judgment she was to ascend to her prepared abode in the heavenly Jerusalem amidst the rejoicings of the multitude and the "voice of mighty thunderings, saying Alleluia, for the Lord God omnipotent reigneth. Let us be glad and rejoice and give honor to him, for the marriage of the Lamb is come, and his wife has made herself ready" (Rev. xix).

The child spoken of in the first quoted chapter played a very secondary part in her delusion; she considered the passage to refer to the last of her two male children and the subject played no further part in her history.

The mission on earth was to be a secret one, and while not hesitating to inform those in the immediate circle of her confidence of its purport, she chose not to herald it to the world, preferring to bide the proper time for the revelation.

N. had in her possession a small, well-thumbed Bible, which she carried with her even at meal-times, and constantly referred to; in truth, the principal part of her time was spent in delving over its pages, searching for references to herself. Each one when found she marked with a round lead-pencil mark of a definite size. Not only were the passages referring to her marked, but a large number of scattered verses of different import were equally distinguished by a mark, having special reference to some idea or thought.

A few typical passages referring to her may be selected, as (Judges xiii) "Behold thou shalt conceive and bear a son, and now drink no wine nor strong drink, neither eat any unclean thing," a mandate she faithfully endeavored to carry out; or, (I Kings iii) "I have given thee a wise and understanding heart, so that there was none like before thee, neither after thee shall any arise like unto thee," or, "For thy Maker is thine husband, the Lord of hosts is his name, and thy Redeemer the Holy one of Israel, the Lord of the whole earth shall he be called."

The other passages marked in the Bible were exceedingly numerous. Commencing with a systematic indication in Judges, they increased greatly in Job and Psalms, gradually diminished in Isaiah and Jeremiah, and decreased to a small number in the latter books of the Old Testament. In the four Gospels they were comparatively infrequent, increased very slightly in the Acts and Epistles, except in Corinthians and Hebrews, where the marks were frequent, and then gradually diminished to Revelation, where only a few chapters were marked, these having especial reference to herself and the New Jerusalem. A rather pathetic notice of the loss of her personal liberty occurred in II Corinthians, where she had marked "where the spirit of the Lord is, there is liberty."

The other very numerous marked verses may be arrayed under six headings: (1), Every passage concerning women in

travail and labor; (2), all passages referring to the rebuilding of the Temple and descriptions of the New Jerusalem, which she appeared to confound; (3), numerous references to her troubles; (4), appeals for help; (5), occasional songs of rejoicing; and lastly, denunciatory passages, which were everywhere indicated and were the most numerous of all, for example, "Behold the day of the Lord cometh, cruel both with wrath and fierce anger to lay the land desolate, and He shall destroy the sinners thereof out of it" (Isaiah xiii).

A considerable number of months passed, N. still retaining her delusions perfectly fixed and systematized, without the addition of hallucinations either visual or aural. She refuted all assertions combating any of these ideas by references to various passages in the Bible, and by the argument that all things in that book are from the mouth of God and therefore beyond the possibility of dispute.

Toward the end of the year 1893 the pulmonary tuberculosis began to make rapid advances, persistent diarrhœas set in, accompanied by much abdominal pain that narcotics only partially relieved. Neuralgic pains in the intercostal nerves also added greatly to her sufferings. Nevertheless she clung persistently to life and waited patiently for the day of her translation, not believing in the least that death would result from disease. Albuminuria now shortly developed, and finally death occurred on February 3, 1894.

A summary of the autopsy shows little of interest. All the principal organs with the exception of the lungs were normal. The brain was slightly reduced in volume; the membranes were normal, the gray matter not reduced in thickness to any appreciable extent. The general texture of the cerebral substance was firm.

The Description of the Cerebrum after Hardening.

a) *The Principal Fissures.*

The Sylvian fissures conform to the usual arrangement, neither ascending limb penetrating upward more than is ordinarily seen.

The Rolandic sulci of neither side show any unusual variations, though the right reaches a little closer to the interhemispheric fissure than its companion sulcus.

Inter-parietal sulci.—In the right hemisphere the post-central furrow commences in the depths of the Sylvian fissure, and extends to within 3 mm. of the margin of the interhemispheric fissure. It is unbroken by secondary gyri throughout its entire length. The inter-parietal furrow commences 32 mm. above the edge of the Sylvian fissure, and is entirely separated from the post-central furrow by a tongue of cortical substance extending from the gyri of the superior parietal lobe to the inferior parietal lobe. After running obliquely upwards and backwards about 30 mm., the fissure is broken by a broad convolution connecting the upper parietal lobe with the region of the angular gyrus. Again commencing behind this gyrus, it immediately throws off a rectangular branch toward the median surface of the brain, the furrow being deeper and longer than is usual, and then following its usual course 20 mm. further, it breaks up into six deep but short radii, and ends, not penetrating downward into the occipital region after the usual fashion.

The companion sulcus of the opposite hemisphere commences at the margin of the Sylvian fissure, runs obliquely upwards, then horizontally, and descending, penetrates deeply into the occipital lobe. The post-central gyrus of this side offers no anomalies in conformation.

The occipito-parietal sulci of both sides are deep; the left extends 3 mm. further into the lateral surface of the brain than the right, and at its innermost point there is a considerable depression, out of which extend five short branchlets, all having their origin in the fissure. The left fissure extends into the fissure of the hippocampal gyrus, the right runs into the calcarine fissure.

The calcarine fissures and the furrow of the corpus callosum follow the usual type.

The formation of the convolutions presents considerable variations from what may be considered the usual development.

b) *Comparison of the Convolutions.*

The gyri of the orbital surfaces of the frontal lobes, the convolutions of the island of Reil, the cerebellum and medulla oblongata, present neither asymmetry nor departure from the usual type.

The Frontal Lobes.—Right Hemisphere.—The superior frontal is very narrow, only 14 mm. in average breadth; and at its posterior end is almost completely separated from the paracentral lobe by a deep upward extension from the sulcus præcentralis crossing through the lobe to the median aspect of the hemisphere. At its anterior end it is fused with the substance of the middle frontal gyrus. The surface is furrowed by a few transverse sulci of little depth. The superior frontal sulcus has nothing noteworthy.

Left Hemisphere.—The first frontal of this side is also narrow, averaging 13 mm. The posterior half of the convolution is split into two separate gyri by a horizontal extension forward of a branch of the præcentral sulcus. The upper limb of the convolution joins the convolutions of the præcentral region, the lower turns obliquely downwards and joins the base of the middle frontal. At its anterior end it is fused with the intricate convolutions of the tip of the lobe. The first frontal sulcus is free from bridging.

Middle Frontal, Left Hemisphere.—This convolution is single, though in its posterior half it is 43 mm. broad, and is conjoined with the anterior central gyrus by a deep-seated pli-de-passage. The gyrus has a large number of short horizontal and transverse sulci of short extent.

Middle Frontal, Right Hemisphere.—The convolution is much broken by short tertiary fissures, and averages 35 mm. in breadth. At its base a strong bridge is thrown across the præcentral sulcus, uniting it with the gyrus cent. ant. About midway of its anterior border, a gyrus 6 mm. in breadth crosses the inferior frontal sulcus to the inferior frontal convolution, and divides the sulcus into two unequal portions, the anterior being the longer. The posterior limb of the sulcus turns downward, penetrates completely through the third frontal, and ends far within the fissure of Sylvius.

The Inferior Frontal, Left Side.—This convolution is

diminutive in comparison with the extraordinarily thick though short fellow of the opposite hemisphere. It averages 11 mm. in breadth, and as already described, is united in its middle portion with the second frontal, and at its anterior extremity with the convolutions of the orbital aspect of the lobe, the inf. frontal sulcus extending far forwards, separating it completely from the convolutions of the second frontal in this region.

The Inferior Frontal, Right Side.—This convolution is of rounded oval form, averaging 32 mm. in width by 59 mm. in length. It is completely separated from all other convolutions of the lateral surface of the lobe; in its posterior portion by the præcentral sulcus, and in all other regions by the inferior frontal sulcus, which winds completely around it and descends to the orbital surface of the lobe. This sulcus is confluent at its posterior end with the præcentral furrow. The convolution is much more complicated than any other of the lobe, the tertiary gyri being numerous. The opercular regions present a uniform view in both lobes.

The sulci præcentrales present the usual bridging extending from the frontal convolutions to the gyrus præcentralis.

Right Præcentral Gyrus.—This gyrus averages 11 mm. in breadth, and is split at its base by a deep tertiary fissure extending from the depths of the Sylvian fissure obliquely upward, finally debouching into the præcentral furrow, thus separating off a portion of the convolution nearly 12 mm. in length. The superior third of the gyrus is slightly broader than the middle portion, and is cut off from the paracentral convolution by a deep transverse incision.

Left Paracentral Gyrus.—This convolution averages 10 mm. in breadth, and is completely broken in its middle third by an unusually deep transverse incision from the sulcus præcentralis penetrating into the Rolandic fissure just above the mentioned bridge from the middle frontal. This deep incision is the only furrow on the convolution, the remaining portions being smooth.

Right Postcentral Gyrus.—The convolution only averages 8 mm., otherwise there is nothing to note.

Left Postcentral Gyrus.—This fold is exceedingly uneven and rugged; in some portions it is 6 mm. wide, in others it is 15 mm.

Right Parietal Lobe.—Besides the unusual development of the gyri crossing the interparietal fissure, the upper lobe is much broken by small vertical sulci, some communicating with the interparietal sulci, others separate from it. In the upper lobe, the gyri supermarginales, while complicated, are not irregular. The angular gyrus is connected with the upper lobe by the above-mentioned inconstant gyrus, otherwise the usual appearance of the region is retained.

Left Parietal Lobe.—The upper parietal lobe is divided into four gyri running vertically from the margin of the interparietal furrow. The inferior lobe has no departure from the customary type.

The occipital convolutions on both sides conform to the ordinary arrangement. The intervening sulci are deep.

Right Temporal Region.—The superior convolutions are doubled in their posterior portions by tertiary sulci, and are correspondingly broad. The inferior convolution is narrow in its anterior half, but broadens out considerably where it is confluent with the third occipital gyrus. The fissures present nothing of importance. The occipito-parietal and hippocampal gyri also have no departure from the usual form.

The left temporal region is in conformity with the usual type.

Median Aspect of the Right Hemisphere.—The inner aspect of the superior frontal averages 20 mm., in breadth, and is much broken by shallow transverse fissures. Near the paracentral lobe a number of oblique fissures mingle with the transverse. The sulcus calloso-marginalis follows its customary course. The gyrus fornicatus is smooth, except where it merges into the præcuneus, and averages 10 mm. in width.

The præcuneus, cuneus, and the internal aspect of the occipital convolutions have no departure from the common types. The sulcus hippocampi is unbroken by bridges.

Median Aspect of the Left Hemisphere.—The internal portion of the superior frontal averages 13 mm. in breadth, and is deeply incised by a tertiary furrow at the point where it joins the paracentral lobule.

Passing toward the corpus callosum we immediately come upon a secondary furrow, which, beginning under the knee of the corpus callosum, extends without break to the middle of the inner aspect of the paracentral lobule, ending within the lobule in a forked branch. Beneath this fissure is a second convolution exactly paralleling the superior frontal, having a breadth of 10 mm. It begins in a thin fold confluent with the superior frontal at a point 10 mm. in front of the optic commissure, and extends from this point unbroken by any deep incision into the anterior portion of the paracentral lobule, joining it just in front of the sulcus paracentralis by a tongue 3 mm. wide. Beneath this convolution lies the proper sulcus calloso-marginalis, which begins by an incision reaching nearly to the floor of the brain and immediately in front of the optic commissure, and after following the course of the corpus callosum, giving off on the way the sulcus paracentralis, it ends in the usual place behind the sulcus centralis. This configuration of the region gives a very broken lobus paracentralis, of less size than ordinary.

The gyrus fornicatus parallels the corpus callosum, is narrow and smooth, and joins with the præcuneus after the usual manner.

There is nothing unusual to note in the configuration of the præcuneus, cuneus or lingual lobe, except that they are more broken into minor convolutions than in the corresponding regions of the opposite hemisphere.

ANGIO-SARCOMA OF THE OVARY.

By Thos. S. Cullen, M. B.

(*Reported at the Johns Hopkins Medical Society, November* 5, 1894.)

L. R., æt. 48. Admitted to the Johns Hopkins Hospital in the service of Dr. Kelly, July 3, 1894.

Upon entering, the patient complained of enlargement in the lower part of the abdomen, pain in the abdomen and also in the back.

Menstruation commenced at 14 years, has always been regular. She has been married over twenty years, has had two children, the youngest of which is 12 years of age. There is also a history of numerous miscarriages.

Family history unimportant.

History of present illness.—In January the menses became profuse and painful and have continued to be so. During May she first experienced severe grinding pain in the left ovarian region. This has continued and at times radiates down the thighs. Simultaneous with the first appearance of the pain a mass was noticed in the abdomen just above the pubes; this gradually increased in size.

On physical examination the lower zone of the abdomen is found distended. The superficial veins are congested, and palpation reveals a firm bilobate mass springing from the pelvis. This extends slightly higher on the left than on the right side.

The anterior lip of the cervix is flush with the vaginal wall; the os is very patulous, admitting the index finger, and on the left side of the cervical canal a soft mass can be felt. The uterus is enlarged and appears to be continuous with the mass on the left side.

July 7, 1894. Operation by Dr. Kelly. Patient in Trendelenburg position.

An incision 19 cm. long was made in the abdominal wall. On the left side the pelvis was found to be choked by a soft mass; this was slightly movable, and extending over it was the rectum, which had been displaced toward the right side.

Both the rectum and sigmoid flexure were attached to the tumor by their posterior surfaces. The left ovarian vessels were secured and enucleation commenced. In loosening the left side the tumor commenced to tear, and it was necessary to hurry the operation as much as possible on account of hemorrhage. The uterus was then amputated at the cervix and the cervical stump closed by five silk sutures. Nodules of the growth still remained in Douglas's cul-de-sac, on the left side where the tumor had been separated, and also between the cervical stump and the posterior wall of the bladder.

A large gauze drain was placed in the lower angle of the wound and the abdomen closed by silkworm-gut sutures which included all the abdominal coats. Duration of the operation 51 minutes.

On the following day the drain was removed and about 15 cc. of thick bloody fluid escaped. The discharge gradually assumed the character of pus, and was still present when the patient left the hospital. There was a slight rise of temperature for the first two weeks, 102.5° F. being the highest point reached. Patient discharged September 3, 1894.

Pathological report.—That portion of the uterus present is 10x12x9 cm. It is irregularly globular, bright red in color, and covered both anteriorly and posteriorly by a few delicate adhesions. The under cut surface is 5 cm. in diameter. The uterus is firm and non-yielding; its walls average 2.5 cm. in thickness, and scattered throughout them are numerous homogeneous fatty-like masses, varying from .5 to 1.5 cm. in diameter. One of these presents dark red patches which are apparently small blood-vessels. The posterior part of the fundus is occupied by a submucous nodule 8x7x5 cm. This is somewhat lobulated and resembles raw beef in color. Springing from the lower margin of the nodule and continuous with it is a finger-like mass 6x4x1.5 cm. This projects into the cavity, and its lower teat-like extremity protrudes from the cervix. The uterine cavity is 7 cm. long and approximately 2.5 cm. in diameter. The mucosa on the anterior surface is whitish yellow in color and 1 mm. in thickness.

Springing from the right side of the cavity is a polyp 1.5 cm. in diameter. The large submucous nodule which projects into the uterine cavity is not covered by mucosa, but presents a slightly worm-eaten appearance.

The right tube and ovary are of small size and apparently normal.

On the left side of the uterus is a mutilated kidney-shaped mass 16x10.5 cm., the convexity of which is directed away from the uterus, while the concave portion is adherent over an area 8x9 cm. During operation the tumor was partially divided into three lobulated masses. On separating these still further from one another, they are seen to be composed of fibres which run in parallel rows. These fibres are light red in color and resemble strands of muscle. *In the centre of each fibre and running parallel with it is a delicate blood-vessel.* Other portions of the tumor are pale, homogeneous and resemble brain tissue, but on further examination are found to be also composed of fibres. There is apparently no breaking down of the tissue. The left tube is 11 cm. long, 5 mm. in diameter. Its outer extremity is adherent to the tumor. The parovarian is intact. No trace of the ovary is to be made out.

Histological examination.—The left ovary is found intimately adherent to the tumor, there being no dividing line between the two. A portion of the ovary is recognized by several large corpora fibrosa and a corpus luteum. The tumor mass is composed of spindle cells cut longitudinally and transversely, these tending to arrange themselves around blood-vessels, which are very numerous.

The vessels have an inner lining of endothelium, surrounding which in some places is a delicate muscular coat, the outer portions of which appear to have undergone hyaline degeneration. Immediately surrounding the muscular coat are 8 to 10 layers of spindle-shaped cells running parallel to the vessel. Such is the condition present where the vascular fibres were seen.

Angiosarcoma of Ovary.

In other portions of the tumor the blood-vessels are not so abundant, and the spindle cells do not maintain any definite arrangement. Many of the spindle cells have large oval nuclei, others show nuclear figures, while some apparently contain 2 to 3 deeply staining nuclei.

Here and there the tumor shows coagulation necrosis, sometimes with, sometimes without nuclear fragmentation, while in other places polynuclear leucocytes are present.

The Uterus.—The nodules scattered throughout the uterine wall are composed of cells precisely similar to those of the tumor. There is, however, no tendency toward the arrangement around blood-vessels. The large nodule projecting into the uterine cavity is similar in nature and presents numerous necrotic areas. On its free surface very little degeneration can be made out.

Uterine mucosa.—The cervical glands are for the most part normal; a few, however, are dilated. The change from the cervical to the uterine mucosa is gradual, the latter being exceedingly thin. The surface epithelium is intact. The glands are scanty in number, cylindrical, and have an intact epithelial lining. Those glands in the depth of the mucosa run parallel to the surface. The stroma of uterine mucosa is of moderate density.

The left tube presents some hemorrhage in the muscular coat, and a few calcareous nodules are seen just beneath the peritoneum. The right tube and ovary also contain a few calcareous nodules.

Diagnosis.—Angio-sarcoma of left ovary. Extension into uterus by continuity and also apparently by metastases, the growth in the uterus being a spindle-celled sarcoma. Atrophy of uterine mucosa, calcareous nodules in both tubes and also in right ovary.

Round and spindle-celled sarcomata of the ovary, although not common, occur with a moderate degree of frequency, and we have been able to gather more than 70 cases from the literature.

Angio-sarcoma of this organ is, however, rare, and in most instances has been described under the title "Endothelioma."

Macroscopically the ovary may retain its normal contour, but be greatly enlarged; sometimes it is lobulated and may be either firm or soft. On section it is often found to contain cyst-like cavities. Some of the tumors appear to be composed of fibres with blood-vessels traversing the centre of each fibre. In these cases a diagnosis can immediately be made.

These tumors have two chief sources of origin: 1st, those arising from the blood-vessels (Amann (4 cases), Ackermann, Eckardt, Marchand); 2d, those springing from the lymphatics (Amann, Flaischlen, Leopold, Marchand, Pomorski, v. Rosthorn, v. Velits and Voigt). These two divisions are again subdivided according as the sarcoma arises from the outer sheath of the vessels or from their endothelial lining.

Our case was undoubtedly perithelial in origin, growing from the outer coats of the blood-vessels. As it is sometimes very difficult, and in fact impossible to say whether it arises from the outer or inner sheath of the vessels, we think the two divisions are sufficient, viz., those arising from the blood-vessels and those springing from the lymphatics.

These tumors have occurred in children 7 years of age, and in women 64 years old. The average of 11 cases was 33 years.

The chief points in our case were the marked adherence of the tumor to the surrounding structures, the typical vascular fibres enabling us at once to diagnose it as angio-sarcoma, and the metastases in the uterus.

DR. WELCH.—I have put under the microscope a specimen of an angio-sarcoma which is parallel to that of Dr. Cullen's. It is a most typical example of angio-sarcoma. A large tumor had grown in the axillary region, developing from the axillary lymphatic glands. It was operated upon by Dr. Keyes in New York. The operation was of unusual difficulty on account of the severe and almost uncontrollable hemorrhage. After the operation the tumor rapidly returned and there were metastases widely distributed in many organs of the body.

Dr. Cullen described his tumor as looking like a mass of muscle fibres. In my case it looked more like a mass of nerve fibres running parallel to each other, each fibre presenting a small central lumen. The tumor consists of blood-vessels running parallel with each other, and the tumor cells form the covering to the blood-vessels. There is an endothelial wall, then a few strands of circular muscle, then a little hyaline material, and then the tumor cells proper. The tissue between these strands is made up to a large extent of extravasation of blood, a few cells and a few strands of connective tissue.

Amann: Archiv f. Gyn., 1894, Bd. XLVI, S. 484.
Eckardt: Zeitschr. f. Geb. u. Gyn., 1889, XVI, S. 344.
Flaischlen: Zeitschr. f. Geb. u. Gyn., Bd. VII, S. 449.
Leopold: Archiv f. Gyn., 1873–74, Bd. VI, S. 202.
Marchand: Beiträge zur Kenntniss der Ovarien-Tumoren, Halle, 1879, S. 50.
Pomorski: Endothelioma Ovarii. Zeitschr. f. Geb. u. Gyn., 1890, XVIII, S. 92.
v. Rosthorn: Archiv f. Gyn., 1891, XLI, S. 328.
v. Velits: Zeitschr. f. Geb. u. Gyn., 1890, XVIII, S. 106.
Voigt: Zur Kenntniss des Endothelioma Ovarii. Archiv f. Gyn., 1894, XLVII, S. 560.

DESCRIPTION OF PLATE.

⅔ natural size.

The specimen is viewed from behind, the uterus being cut open. On the left side a large, somewhat lobulated and torn mass is seen; attached to the outer margins of this are a good many adhesions. The lower and inner portion of the tumor is composed almost exclusively of fibres running parallel to one another. The mass is intimately adherent to the left side of the uterus.

The uterus is at least three times its normal size, its walls being twice their usual thickness, while studding the uterine muscle are irregularly lobulated or round nodules. These are of a yellowish waxy appearance and stand out prominently. The uterine cavity is occupied by a large submucous nodule, attached to the lower surface of which is a ragged mass that projects into the cervix. The lower portion of the uterine cavity and a small part of the cervical canal are visible.

To the right of the uterus portions of the right tube and ovary can be distinguished.

PROCEEDINGS OF SOCIETIES.

THE JOHNS HOPKINS HOSPITAL MEDICAL SOCIETY.

Meeting of November 5, 1894.

Dr. Kelly in the Chair.

Exhibition of Specimens from a Case of Deciduoma Malignum.—Dr. J. Whitridge Williams.

Dr. J. Whitridge Williams exhibited the specimens from a case of deciduoma malignum.

The case presented the following history: R. W., aged 35 years, was a full-blooded negress, both her parents having been born in Africa. Family and past personal history have no bearing on the case. Has had five normal labors; the third pregnancy terminated in a miscarriage at the sixth month.

During the last pregnancy she complained a good deal of headache, and the urine four days before labor contained a slight amount of albumen and a few hyaline casts, which, however, disappeared on the following day. She was delivered of a dead, full-term child about the 15th of April, 1894, after a normal labor with a vertex presentation. The labor lasted about 30 hours, and a good deal of blood was lost during the third stage, but there was no hemorrhage after the expulsion of the placenta. The puerperium was not entirely normal, the temperature remaining at about 100° and the patient being very much prostrated. Her physician saw her for eight days and then discontinued his visits, leaving her a tonic. About a week later the patient's mother informed him that there was a small and painful "waxen kernel" about the size of a pea on the right labium majus, for which he prescribed a soothing wash, without seeing the patient. Three weeks after the labor he was called once more to the case, and found the right labium swollen to about the size of a hen's egg and very painful. In it was a bright red tumor the size of a walnut, which rapidly increased in size and soon became gangrenous and ulcerated on the surface. So that a month after labor the tumor was the size of a hen's egg, markedly necrotic on its surface, and accompanied by hemorrhage and a very odorous discharge. It was not possible to say whether all the hemorrhage came from the vulva, or whether a part of it also came from the uterus. As the patient's condition was rapidly growing worse, the physician advised her to enter the Maryland General Hospital, where she died, July 12, 1894, three months after the birth of the child.

At the hospital it was said that she was suffering from septicæmia and that a large sloughing mass occupied nearly the whole of the right labium and the adjacent tissue. In the center of the mass was a fistulous opening into the rectum, through which fæces were discharged. The temperature varied from 99° in the morning to 103° in the evening, but during the last three weeks of life did not rise above 100°.

Death from exhaustion. The clinical diagnosis was "sloughing hæmatoma of the vulva."

The autopsy was performed by Dr. W. T. Howard, Jr., who kindly placed the case at my disposal.

At the autopsy, the entrance of the vulva was found to be surrounded by a large, irregular sloughing mass 10 cm. in diameter, which extended some distance up the vagina, where it had ulcerated through into the rectum, forming a recto-vaginal fistula.

The uterus itself was about twice the normal size, and from its posterior wall arose a mass 2½ by 1½ cm., which projected about 1 cm. into the uterine cavity. Its exterior was grayish and necrotic in appearance, but on section it presented a reddish-brown, spongy appearance, somewhat suggestive of placental tissue. There was also a small tumor of the same character in the fundus. In the vagina, between the cervix and the growth at the vulva, there was a round ulceration 1½ to 2 cm. in diameter.

The growth at the vulva, as is readily seen from the specimen, presented a very marked sloughy appearance.

The uterine tumors are very small and would hardly seem likely to give rise to any great trouble, but the occurrence of metastases in other organs demonstrated their malignant character.

Both lungs, especially in their peripheral portions, were filled with metastases which varied from a pea to an English walnut in size, and varied in color from grayish to grayish-red; they all presented a sponge-like structure and were extremely suggestive of placental tissue. Smaller metastases of the same character were found in the liver and also in the kidneys. There was a large infarction in the spleen and several small metastases, and also one at the hilum of the right ovary, the size of a hazel-nut.

The interesting feature of the case is its very rapid course; the uterine tumors apparently developing after the birth of the last child, and causing death from sepsis and the formation of metastases in less than three months.

This case belongs to the group of uterine tumors to which Sänger first directed attention and designated as "deciduoma malignum." Under the microscope, the primary uterine tumors, as well as the metastases, consist of a meshwork of tissue, with the meshes filled with blood, and the tissue itself composed of large, irregularly shaped cells with variously shaped nuclei which stain very deeply.

These cells at first sight closely resemble epithelial cells, but any one who is familiar with the structure of the uterus is immediately impressed with their similarity with the cells of the normal decidua, and closer study shows that they are identical with them, and that we have to deal with a hemorrhagic sarcoma arising from the decidua cells.

The first case of this variety was observed by Sänger in 1889, and last year he wrote an exhaustive monograph upon the subject. He showed that the cells composing it were identical with the decidua cells, and that the entire growth must be looked upon as a sarcoma arising from the decidua. The facts seem to bear him out, and any one who will take the trouble to examine the sections which we present of our tumor, and compare them with the sections of the normal decidua, will at once see a marked likeness.

Sänger at first proposed to call the growth "deciduoma malignum," but in his monograph he stated that the term had not been well chosen, and suggested instead the term "sarcoma deciduocellulare," so that its sarcomatous nature would be expressed by it.

Pfeiffer, a pupil of Chiari, observed a similar case about the same time, and likewise, without any knowledge of Sänger's publication, proposed the name "deciduoma malignum" for it.

Since that time a considerable number of cases have been reported, 13 in all. Our case makes the fourteenth, and is the first case to have been observed in America, and the only case observed in the negro race.

It is also of interest that nearly all the cases occurred in young women, for in 8 of the 13 cases already described the women were under 30 years of age, the majority being from 24 to 26 years old. This is a marked contrast to the carcinomata which usually appear about or after the menopause.

I exhibit the specimen and report the case in this brief manner merely to put it upon record, as it will be carefully worked out and published in detail at a later date.

The Best Method of Sharpening a Microtome Knife.—Dr. Lotsy.

During my stay at the Botanical Laboratory in Gröningen I had the good fortune of becoming acquainted with Dr. Moll's method of sharpening microtome knives. His method is superior to any other, in that it allows one to put the knife in good shape inside of a few minutes for any section he wants to cut. Before using this

method, any concavity of the knife blade must first be taken away. Dr. Moll uses a plate of polished glass which is fixed in a piece of wood, and two different powders, viz., Vienna chalk and diamantine. A paste is made of one of these powders and put upon the glass; then the knife is simply moved backwards and forwards upon the glass over the paste. By means of the Vienna chalk you can polish your knife in a very few minutes. The diamantine allows you to put a sharp edge on it, but does not give a polished surface, but rather a rough one. Now when you have a knife which is highly polished you can cut a section of, say, 5μ perfectly well, but if you try to cut with it a section of 1 to 2μ you will not succeed at all, your sections will become compressed and wrinkled and you can do nothing with them. On the other hand, if you try to cut a section of 5μ with a knife having a rough surface your section rolls up. This rolling up of a section has been represented to be a fault in the paraffine, but that is not the case; we must adapt the knife to every thickness of section we wish to cut. Starting out with a certain knife, if your section curls up, the proper thing to do is to polish your knife with Vienna chalk, and your section for that thickness will not curl up any more.

If your section becomes too much compressed, your knife should be rubbed over the diamantine and the polished surface taken away, when the sections will be cut without compression.*

Ureterotomy.—Dr. KELLY.

I wish to speak briefly concerning a novel operation which I have had occasion to employ within the last six months.

The importance of placing bougies in the ureters before beginning a difficult operation upon the pelvic organs in which the ureters may be involved has been dwelt upon by me before the society at previous meetings. While this is practicable in nearly all cases, it is not advisable where time is a large factor in the operation, as placing the patient in the knee-breast position and searching for the ureters, particularly if the operator is not an adept in ureteral catheterization, may consume much valuable time after the patient is under the anæsthetic. Under these circumstances it is best to proceed at once with the operation, observing the greatest care in placing sutures in the ureteral areas.

Within the last year I have performed three operations, at the completion of which I feared the ureter had been ligated, as it appeared in each instance to be enlarged.

It was impossible to ascertain certainly whether this accident had occurred without either taking out a large number of ligatures which had been placed in the ureteral area, or catheterizing the ureters. In either event the danger would have been much greater to the patient than the operation which I am about to describe. To remove all of the ligatures in the ureteral area and religate all of the bleeding vessels would have consumed too much time, and the catheterization of the ureters would have been still more impracticable.

For these reasons I determined to resort to ureterotomy as the easiest solution of my dilemma. Accordingly I located the ureter at the pelvic brim, snipped the peritoneum over its course, and made a longitudinal incision ½ cm. in length into the lumen, through which I passed a small ureteral sound down into the bladder. In two cases, of the three, I found the ureters free, the enlargement being simply due to the pressure of the pelvic mass previous to the operation. In the third case, however, I found that the ureter had been included *en masse* with a large area of bleeding tissue in the pelvic floor. I at once removed the constricting ligature and was able to pass the sound into the bladder. By this simple operation much valuable time was saved, and uninterrupted recoveries in each case justified the statement that the operation is without danger.

In closing the slit in the ureter I have used the delicate mattress sutures in two cases. The third required four sutures on account of the persistent oozing of urine. These sutures are very lightly passed into the outer coat of the ureter, not entering its lumen.

The cases in which I have resorted to this operation have been myoma uteri, carcinoma uteri, and dense pelvic inflammatory disease.

All of the patients have made complete recoveries and there have been no apparent ill effects from the operation up to this time.

I used gauze drainage in each case and there was not the slightest urinary odor detected at any time on the dressings.

While, as I have stated, I do not consider the operation a dangerous one, I do not advise it except in such instances as I have just spoken of. If there is grave doubt as to whether the ureter has been ligated or cut I earnestly advise this diagnostic measure, as I feel assured that a certain number of lives will be saved in this way.

A New Method of exploring the Rectum and Sigmoid Flexure.—Dr. KELLY.

What I wish to do this evening is not to speak of the principles involved, but to demonstrate my method of examining the lower bowel. I will be able to show you through the rectal speculum further inside the lower intestinal canal than has ever been exhibited before without the intervention of artificial light or mirrors or a glass diaphragm between the eye and the part to be inspected.

I have for quite a number of years, even while I was in Philadelphia, been in the habit of examining a dilated rectum with the patient in the knee-breast posture, and this is the main feature in a satisfactory examination. So many patients have come to me lately suffering with pelvic inflammatory troubles, pelvic abscesses, etc., associated with stricture of the rectum or with tenesmus and frequent passages containing large quantities of mucus, that I have found it necessary to examine these patients minutely in order to definitely localize the disease of the bowels. For this purpose I have devised instruments which enable me to examine at a glance the whole of the lower part of the rectum, and not only the lower part of the rectum, but also that portion which lies above the ampulla and the sigmoid flexure, beyond the promontory of the sacrum. With the largest speculum I am able to enter the descending colon, and I hope in time to inspect even the transverse colon.

The instruments employed are simple and few in number. Instead of a series of rectal dilators, I find a conical dilator best, varying in size from the point, 2 cm. in diameter, to the base, 6 cm., which is equivalent to a large series. This dilator must be well anointed with vaseline, and then by a boring movement one can dilate the rectum equably, without pain, and much better than is possible by simply pulling with the fingers from tuber ischium to tuber ischium. After using the dilator I take one of these cylindrical specula, made according to the same pattern as my bladder specula. Each speculum is accurately fitted with an obturator which facilitates its introduction and prevents any injury to the bowel. With the patient in the knee-breast posture I gently introduce the speculum, letting it take its own course as much as possible. Knowing the general course of the rectum, I am able to guide the instrument safely into its upper third and thence into the sigmoid flexure.

This is one of the shorter specula intended only for proctoscopy. The rectum is now well distended and you can see the minutest macroscopic lesion if there be one. Having inspected the rectum, I next introduce the long cylinder, and by guiding it over the promontory of the sacrum I at once open up the greater length of the sigmoid flexure for inspection.

This method of examination of the rectum opens up a very

*The materials used can be gotten at the following prices from Chas. Neuhaus & Co., 510 N. Eutaw street, Baltimore, who ordered them at my request: New knives, warranted to be good, $3; diamantine, 30 cents a bottle; Vienna chalk, 10 cents for 4 ounces; glass plates, 90 cents.

interesting field, and also throws light upon certain diseases which before have been obscure.

A case which recently left Ward B aptly illustrates this statement. The patient had suffered for a number of years with intense pain in the lower bowel and diarrhœa. The stools contained mucus and were often bloody in character.

Upon inspecting the rectum and sigmoid I was surprised to find the disease a true proctitis, and that the sigmoid appeared to be perfectly healthly.

I at once instituted topical treatment of silver nitrate and ordered a rectal douche, and the patient made a most satisfactory recovery. Strictures of the lower bowel can be accurately located by this method.

In conclusion I will repeat that the success of this method of examination depends entirely upon the posture.

Double Castration for Hypertrophy of the Prostate Gland.—Dr. FINNEY.

There is really nothing to be seen in this patient, but I take the opportunity before he leaves the hospital of calling your attention to the case. In 1893, before the American Surgical Association, Dr. J. Wm. White, of Philadelphia, in a paper on "The Hypertrophy of the Prostate Gland," first suggested the advisability of double castration in obstinate cases. He had at that time not operated himself. His line of argument was briefly as follows: While the prostate and the uterus are not embryologically homologous, still they are very much alike histologically. Certainly, from work dating back to the time of John Hunter and others, the prostate has been shown to have definite sexual relations. It enlarges during sexual life. During the wane of sexual life certain definite changes take place in it which are closely allied to similar changes in the uterus. After a certain length of time, as in uterine myomata, the prostate undergoes certain degenerative changes. This suggested to him the possibility that castration might have an effect upon these growths similar to the effect of ovariotomy upon the uterine myomata. Some time elapsed before the first case was operated upon by Dr. Haynes, of Los Angeles, California. About the same time Ramm, of Christiania, had operated upon two cases entirely independently of Dr. White's suggestion. A review of his article appeared in the "Annals of Surgery" soon after the meeting of the American Surgical Association. A collection of all the cases that Dr. White could find recorded appeared in the Medical News in June last. He there reports nine cases, and since that time a number of others have been reported. In all favorable changes have been noted, and in some, almost an entire relief of the symptoms.

This patient entered the hospital in August '94, complaining of inability to urinate and constant dribbling of urine, dating back two years. He had to resort to the constant use of the catheter. At that time examination of the prostate showed it to be very much enlarged. The urine contained a trace of albumen, very few casts, slight amount of pus; was acid, and specific gravity 1.014. Upon catheterization 420 cc. of urine were drawn off. The capacity of the bladder was about 1000 cc. The bladder was much dilated and atonic. Examination for stone negative. The patient was put upon the regulation treatment, washing out the bladder, regular catheterization and the usual internal medication. Still he was unable to void his urine, so the operation of castration was proposed. He very willingly agreed to it and it was performed September 22, '94. On the sixth day following he urinated unassisted, and since that day, with one or two setbacks, he has done well. He has had occasional attacks of pain in the right side along the ureter and over the kidney, after which there appeared a little pus in the urine, but nothing more definite. The last note in his history five weeks after operation is as follows: "The lateral lobes of the prostate are just palpable to the right and left of the silver catheter previously introduced. They are soft, not tender, and show marked atrophy. There is now not more than 50 cc. of residual urine; total amount 1200–1500 cc. He urinates about seven times in the 24 hours. In other respects he is in very good condition."

Very recently I have operated upon a second patient in private practice. His trouble was of five years' duration, with inability to urinate for two years past. The prostate was much enlarged: the urine contained pus and albumen in small amount. From frequent and rough using of the catheter, a false passage had been made, and later catheterization became very difficult and painful. For this reason the operation of castration was advised. He has urinated without difficulty since the fifth day.

NOTES ON NEW BOOKS.

A Manual of Modern Surgery, General and Operative. By JOHN CHALMERS DA COSTA, M. D. (*Philadelphia: W. B. Saunders*, 1894.)

This book, of nearly 800 pages, is divided up into 37 sections, the first 16 of which are devoted to bacteriology, pathology and general diseases, the remainder to local affections. The chapter on bacteriology is short and shows some rather important mistakes and omissions.

The bacillus of actinomycosis is still classed with the fungi; and this mistake again occurs in the chapter on actinomycosis. Amongst the organisms cited as pus-producers, the staphylococcus epidermidis albus, the common cause of stitch abscesses and suppuration along drainage tubes, is not mentioned. The gonococcus, which is usually described as a pus-forming organism, is placed under the heading "Other Surgical Microbes." Under this last heading are placed those organisms occurring in surgical diseases and not strictly pus-formers. The diplococcus lanceolatus, a frequent cause of empyema and of infections about the mouth, is not mentioned, nor is the typhoid bacillus, a not uncommon cause of bone disease and suppuration.

The class protozoa is not mentioned, though the amœba coli is a frequent cause of a strictly surgical disease, abscess of the liver.

The bacterium coli commune is merely mentioned as the supposed cause of peritonitis, though most authors regard it as the common cause of appendicitis and also of cystitis.

The pathological portion of the chapter on inflammation is a short resumé of the Cohnheim theory; the clinical portion is very full and complete.

The chapter on tuberculosis and scrofula could be improved, we think, by leaving out scrofula; the term scrofula is out of place in a text-book of modern surgery, scrofula being a relic of bygone days, and conveying to the mind the idea of a series of clinical symptoms without any definite pathological basis.

The statement that the leprosy bacillus is the only bacillus besides that of tubercle, in which the aniline stain is not removed by acids is incorrect, the common smegma bacillus resisting acids also, and being practically indistinguishable from the tubercle bacillus by ordinary methods of staining.

The chapter on syphilis is good; the most modern treatment, however, is not to give either mercury or the iodides for lengthy periods of time, but to alternate the two.

The chapter on new growths is fairly complete; a few of the rarer tumors, as the deciduomata, implantation and foreign body cysts, and malignant adenoma of the thyroid, are not mentioned.

The chapter on diseases of the bones and joints is perhaps the most satisfactory in the book, the portion devoted to fractures and dislocations being especially good. Plaster is not used as a rule in the early stages of fracture, and the ambulatory treatment of fractures is not spoken of.

The chapter on diseases and injuries of nerves is short and to the point; the author has rather more faith in restoration of func-

tion after nerve suture, than the work of experimental physiologists would seem to justify.

In the chapter on the surgery of the respiratory organs no mention is made of the surgical treatment of pulmonary cavities, which, though undoubtedly limited, is o use in some picked cases of bronchiectasis.

In the chapter on diseases and injuries of the lymphatics, the treatment of chronic adenitis should not be confined to constitutional treatment in all cases; the knife should at least be mentioned.

Asepsis and antisepsis, the safeguards of modern operative surgery, are accorded 5 pages out of 785. Not nearly enough space is given to this subject, and a much more detailed account of technique, dressings, etc., should have been given.

Taking the operative section of the book as a whole, the great fault is the entirely too frequent use of the drainage tube.

The author's style is clear, but rather too didactic; in places errors are made in quoting, for instance we could imagine that Dr. Burdon Sanderson would object to being called Burden-Sanderson.

Edinburgh Hospital Reports, Vol. I, 1893, Vol. II, 1894. Edited by Drs. GIBSON, CATHCART, THOMPSON, and BERRY HART. (*Young J. Pentland, Edinburgh, Scotland.*)

These splendid volumes form a contribution worthy in every respect of the Edinburgh school. The introductory articles in Vol. I deal with the history of the Royal Infirmary, the Royal Hospital for Sick Children, and the Royal Maternity and Simpson Memorial Hospital.

A very fitting tribute is paid by Sir Grainger Stewart to the memory of Hughes Bennett, to whom, more than to any other man, the credit is due of establishing the Edinburgh method of bedside instruction.

In Vol. I the medical papers predominate; many of them consist of the reports of cases of special interest; others are more elaborate and consist of analyses of the collected hospital material. A unique instance of a tumor in the right ventricle acting as a ball-valve is reported by Professor Gairdner of Glasgow.

The surgical and special papers occupy scarcely a quarter of the volume, but contain a number of most interesting articles, among others, on three cases of the somewhat rare *kopftetanus* of Rose. As a supplement to the volume are the reports of the medical and surgical registrars.

Vol. II opens with a most interesting article by Professor Gairdner on the Royal Infirmary in the fifties. The personal notices of Begbie, Murchison, Sanders and others are particularly attractive. Dr. John Wyllie, in a paper on the diagnostic value of patterns of abdominal tumidity, calls attention to many points which are too often neglected, and there are few surgeons or physicians who could not derive valuable information from the cases which he there reports and from the excellent illustrations.

Dr. Leith's paper on actinomycosis, which is illustrated by five plates of exceptional beauty, not only gives an excellent anatomical account of the disease, but an analysis of recorded cases. The same writer contributes an exhaustive paper on acute perforating ulcer of the stomach. This lesion seems to be very frequent in Edinburgh, as it is stated by Dr. Gillespie, in Notes on the Medical Statistics, that during the year 87 cases were treated. There are several valuable contributions on diseases of the heart by Gibson, Muir, Thompson, and Mackenzie.

Sir Grainger Stewart records a most anomalous case of nervous disease with an extraordinary gait and misplacement of the sensory impressions.

We are glad to see the word appendicitis in one of the surgical papers, as indicating that, in North Britain at least, writers are beginning to abandon the old misleading terms of typhlitis and perityphlitis.

Among the surgical papers is a valuable one by Dr. Stiles on tuberculosis of the tunica vaginalis testis.

These volumes are unusually rich in important and practical contributions to medicine and surgery, and afford proof—if indeed that is needed—of the continued activity of the Edinburgh school.

The typography of the volume is, for hospital reports, exceptionally good, and the paper, type and plates are in Mr. Pentland's very best style.

I. IJIMA and T. KURIMOTO—On a new human Tape-worm (*Bothriocephalus* sp.); The Journ. of the College of Science, Imperial Univ., Japan, VI, 1894, pp. 371-385, Pl. XVIII.

R. BLANCHARD—Notices sur les Parasites de l'Homme: IV.—Sur le *Krabbea grandis*, et remarques sur la classification des Bothriocéphalines; Compt. rend. d. l. Soc. d. Biol., Paris, 1894, pp. 699-702.

Although we frequently find parasites which are additions to the fauna of the human body, it is now quite a rare occurrence to find a parasite in man which represents a new zoological species—much less a new genus. The two papers cited above are, therefore, deserving of more than a passing notice.

Ijima and Kurimoto have recently found a very large tape-worm in man which differs radically from any form ever recorded for the human species, but which agrees in certain important anatomical characters with some tape-worms reported in seals (*Phoca*).

The patient who harbored this parasite had lived for the greater part of his life on the seaboard. He was born in the province Hizen, and had never been in any other part of the country. After suffering for five years at irregular intervals with attacks of vertigo and colic, exhibiting also a progressive anæmia, he passed a fragment of a tape-worm. The attacks of colic returned and increased in violence. After a dose of anthelmintics he passed more of the parasite and the symptoms disappeared.

The head of the worm was not found, but from the general structure of the segments examined, it may be concluded that there are two (one dorsal and one ventral) groove-suckers, agreeing approximately with the head of *Bothriocephalus latus*. The worm is estimated at about 10 metres in length; the broadest segments measuring 25 mm. in breadth when fresh, and 14-16 mm. when preserved in alcohol, and are remarkably short, the largest measuring only 0.45 mm. long. The general structure of the genitalia agrees with that of *B. latus*, but instead of there being only one set in each segment, two sets are found, one on each side of the median field; two longitudinal grooves are seen on the ventral surface of the worm, each groove containing in each segment the openings (penis, vagina, uterus) of one set of genital organs. The egg is oval, 63μ by 48-50μ, with a thick brown shell.

The presence of two sets of genital organs is the special character to be borne in mind in connection with this species. Blanchard, the Parisian medical zoologist, proposes to erect a new genus for tape-worms of the family *Bothriocephalidæ* which present this arrangement of the genitalia, naming the genus *Krabbea* (after the Danish helminthologist), and establishing the combination *K. grandis* for the species described by Ijima and Kurimoto. In this same genus he also places the species *Krabbea fasciata* (Krabbe) R. Bl. 1894, *Kr. variabilis* (Krabbe) R. Bl. 1894, found in *Phoca*.

It is extremely interesting to note this parallel in the families *Bothriocephalidæ* and *Tæniadæ*. In both families we find tape-worms with single genital pores (*B. latus* and all others of this genus, *Tænia solium*, *T. saginata*, *Hymenolepis diminuta*, etc., etc.), and those with double genital pores (the genus *Krabbea*, in the first family, and the genera *Moniezia*, *Ctenotænia* and others in the latter family). In the genus *Thysanosoma* (*Tæniadæ*) we find one species in this country (*Th. actinioides* of sheep) which always possesses double pores, while in Europe we find another species (*Th. Giardi* in sheep) which generally possesses single pores, but occasionally has double pores.

From Blanchard's article the following key may be compiled for the determination of species of the collective genus *Bothriocephalus*:

1 { Genital organs single..... 2
  { Genital organs double..... 4

2 { Genital openings lateral (marginal), *Bothriotænia* Railliet, 1892.
  { Genital openings ventral or dorsal..... 3

3 { Penis, vulva and uterus open ventro-median, *Bothriocephalus* Bremser, 1819.
  { Penis and vulva ventro-median; uterus opens dorso-median, *Ptychobothrium* Lönnberg, 1889.

4 { Penis, vulva and uterus open ventrally, *Krabbea* R. Bl., 1894.
  { Penis and vulva open ventrally; uterus opens dorsally, *Diplogonoporus* Lönnb., 1892 (*Amphitretus* R. Bl., 1894).

STILES.

WASHINGTON, D. C.

Text-book of Hygiene: a Comprehensive Treatise on the Principles and Practice of Preventive Medicine from an American Standpoint. By GEORGE H. ROHÉ, M. D. Third edition, thoroughly revised and largely rewritten, with many illustrations and valuable tables. (*Philadelphia: The F. A. Davis Co., Publishers*, 1894.)

A second edition of this excellent work was noticed in the BULLETIN for January, 1891. The fact that a third edition has been called indicates a growing popular interest in preventive medicine. The present edition has been enlarged by the addition of upwards of a hundred pages, and many of the chapters have been entirely rewritten. Useful additions to the chapters on Quarantine, Examination of Air, Food and Water, and Vital Statistics have been made by Surgeons Wyman and Geddings of the Marine Hospital Service, and Prof. Egbert of Philadelphia. A series of questions has also been appended to each chapter to facilitate the use of the book in the class-room. The book is a simple, unpretentious, practical manual especially adapted to the use of health officers and medical students.

A Dictionary of Medicine, including General Pathology, General Therapeutics, Hygiene, and the Diseases of Women and Children. By various Writers. Edited by RICHARD QUAIN, M. D., LL. D., F. R. S., assisted by FREDERICK T. ROBERTS, M. D., and J. MITCHELL BRUCE, M. D. With an American Appendix by S. T. ARMSTRONG, M. D., Ph. D. New Edition. Revised throughout and enlarged. 2 vols., pp. xxiv, 1261, and viii, 1305; 181 illustrations. (*New York: D. Appleton & Co.*, 1894.)

The original issue of this work in 1882 was a single volume of 1834 pages. The present edition, reprinted in larger type, is in two volumes of upwards of 2600 pages, and has been revised and much new matter has been added. Most of the articles are systematically written and exhaustive, and the work can be recommended as a book of reference for students and practitioners. The merit of the different portions, as might naturally be expected from so many writers, varies materially, and there are some repetitions and inconsistencies in the various articles. It is clearly and attractively printed and the illustrations are good.

A careful reading of the articles discloses some important omissions. Thus under the head of dysentery no reference is made to the excellent and exhaustive work of Councilman and Lafleur which has contributed so much to the pathology of amœbic dysentery. The treatment laid down for appendicitis is not in accordance with modern ideas, and while surgical interference is mentioned as recommended by some, its importance is not emphasized. Sir William Gull's obsolete term, arterio-capillary fibrosis, is employed and carefully explained, but the more modern one, arterio-sclerosis, is not mentioned. There is no article on blood examination, and even in the article on leucocythaemia no reference is made to the important aid derived from the Ehrlich methods of blood examination. In the operative treatment of carcinoma of the breast, excision of the glands in the axilla is recommended, but nothing is said of the much more important procedure of removing the pectoral muscle. In the article on insanity no mention is made of paranoia, although a misleading and inadequate definition is given in the Appendix to the effect that English alienists use the term "delusional insanity" in its place. The term "*primary* delusional insanity," which is quite a different matter, was once used by English and American alienists, but the term paranoia has been adopted instead as shorter and equally satisfactory. In describing the micro-organisms of malarial fever, the causative relation of the *plasmodium malariæ* is not stated as definitely and positively as we are justified in doing in the light of our present knowledge. The chapter on diseases of the womb is inadequate and fails to give a just conception of the modern nomenclature, pathology or treatment of these disorders. The American Appendix savors more of the character of a medical dictionary than of a dictionary of medicine. It is a medley of short definitions of rarely used medical terms, and of slip-shod descriptions of diseases and names of American mineral springs—the mineral springs predominating—and adds little to the value of the work.

Text-book of Anatomy and Physiology for Nurses: Compiled by DIANA CLIFFORD KIMBER, Assistant Superintendent, New York City Training School, Blackwell's Island, N. Y. (*New York and London, Macmillan & Co.*, 1894.)

It is always a difficult task to determine how much theoretical knowledge ought to be included in a text-book intended for the sole instruction of nurses. Some manuals for nurses err upon the side of too great conciseness, while others are so full of all manner of specialized information it is questionable whether they are fitted for the use of nurses at all and are not rather general text-books. It should not be forgotten that the object of all text-books for nurses is to give them assistance in practical work. A happy mingling of theoretical knowledge with the requisite technical instruction required by practical work seems to have been attained in the volume before us. The lessons are progressive and so arranged as to unfold anatomy and physiology to nurses in a natural, helpful manner. The physiological discussions follow easily upon anatomical descriptions in such a manner as to make an impression upon the student.

The volume is beautifully printed and well illustrated, and the author deserves much credit for her work as compiler. The glossary and index are especially satisfactory.

BOOKS RECEIVED.

A Collection of the Published Writings of William Withey Gull, Bart., M. D., F. R. S. Edited and arranged by T. D. Acland, M. D. Medical Papers. 8vo, 600 pages. 1893. Published by the New Sydenham Society, London.

A Dictionary of Medicine, including general pathology, general therapeutics, hygiene and the diseases of women and children. Edited by R. Quain, assisted by F. T. Roberts and J. M. Bruce. With an Amer. appendix by S. T. Armstrong. New edition, revised throughout and enlarged. 4to. 1894. 2 vols. D. Appleton & Co., Publishers, New York.

A History of Epidemics in Britain. By Charles Creighton. Vol. II. From the extinction of plague to the present time. 8vo, 883 pages. 1894. University Press, Cambridge.

A Manual of Modern Surgery, General and Operative. By J. C. Da Costa, M. D. (Saunders' New Aid Series), 1894. 12mo, 809 pages. Published by W. B. Saunders, Philadelphia.

A Monograph on Diseases of the Breast. Their Pathology and Treatment. With special reference to Cancer. By W. R. Williams, F. R. C. S. 8vo, 572 pages. 1894. John Bale & Sons, Publishers, London.

An American Text-Book of Surgery, for Practitioners and Students. By C. H. Burnett, P. S. Conner and others. Edited by W. W. Keen and J. W. White. Profusely illustrated. 4to, 2 v. 1893. W. B. Saunders, Publisher, Philadelphia.

An Illustrated Dictionary of Medicine, Biology and Allied Sciences. By George M. Gould, M. D. 4to, 1633 pages. 1894. P. Blakiston, Son & Co., Publishers, Philadelphia.

A Practical Treatise on Medical Diagnosis, for Students and Physicians. By John H. Musser, M. D. 8vo, 881 pages. 1894. Lea Brothers & Co., Publishers, Philadelphia.

Clinical Lectures on Medicine and Surgery. By various German authors. 8vo, 3d series, 397 pages. 1894. Published by the New Sydenham Society, London.

Paludism. By Dr. A. Laveran. Translated by J. W. Martin, M. D., F. R. C. P. E. 8vo, 197 pages. 1893. Published by the New Sydenham Society, London.

Practical Uranalysis and Urinary Diagnosis. A Manual for the Use of Physicians, Surgeons and Students. By Charles W. Purdy. With numerous illustrations, including photo-engravings and colored plates. 8vo, 357 pages. 1894. The F. A. Davis Co., Publishers, Phila.

Text-Book of Hygiene. By George H. Rohé, M. D. 3d edition. 8vo, 553 pages. 1894. The F. A. Davis Company, Publishers, Philadelphia.

Text-Book of the Theory and Practice of Medicine. By American teachers. Edited by William Pepper, M. D. Illustrated. 4to, 2 vols. 1894. W. B. Saunders, Publisher, Philadelphia.

Transactions of the Michigan State Medical Society for the Year 1894. Vol. XVIII. 8vo, 586 pages. Published by the Society, Detroit.

Twenty-Fifth Annual Report of the State Board of Health of Massachusetts. 8vo, 812 pages. 1894. Wright and Potter Printing Co., Boston.

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